RECITATION: Monday, 4:00pm to 4:50pm in Yates 104 (attendance mandatory)
LAB: Yates 311.

LAB sections 1, 2, 3: Tues 9:00 - 11:50AM, Tues 2:00 - 4:50PM, Wed 9:00 - 11:50AM,
Instructor: Dr. Farida Safadi-Chamberlain
Office hours: Wednesday 12:15-1:15pm, Friday 11:00am-12:00pm in Yates 310 or by appointment.
Office: MRB 285, Phone 491-1771
Email: fsafadi@lamar.colostate.edu

LAB sections 4, 5, 6: Wed 2:00 - 4:50PM, Thurs 9:00 - 11:50AM, Thurs 2:00 - 4:50PM
Instructor: Dr. Corey Rosenberg
Office hours: Mon 3-3:50pm in MRB 375, Wed 12:45-1:45pm in Yates 310 or by appointment.
Office: MRB 375, Phone 491-6809
Email: corey.campbell@colostate.edu

Teaching assistants:

<table>
<thead>
<tr>
<th>TA name</th>
<th>Office hours</th>
<th>Office location</th>
<th>Lab Section</th>
<th>Email address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kevin Cavanaugh</td>
<td>Tue 2:00-3:00pm</td>
<td>Yates 310</td>
<td>1</td>
<td><a href="mailto:Kevin.Cavanaugh@colostate.edu">Kevin.Cavanaugh@colostate.edu</a></td>
</tr>
<tr>
<td>Paige Charlins</td>
<td>Thu 11:15-2:15pm</td>
<td>Yates 310</td>
<td>2</td>
<td><a href="mailto:pecharlins@gmail.com">pecharlins@gmail.com</a></td>
</tr>
<tr>
<td>Nathan Sindt</td>
<td>Mon 1:00-2:00 am</td>
<td>Yates 310</td>
<td>3</td>
<td><a href="mailto:Nathan.Sindt@colostate.edu">Nathan.Sindt@colostate.edu</a></td>
</tr>
<tr>
<td>Leah Blackwell</td>
<td>Mon 12:00-1:00 pm</td>
<td>Yates 310</td>
<td>4</td>
<td><a href="mailto:leahnblackwell@gmail.com">leahnblackwell@gmail.com</a></td>
</tr>
<tr>
<td>Anna Garber</td>
<td>Thu 3:00-4:00 pm</td>
<td>Yates 310</td>
<td>5</td>
<td><a href="mailto:Anna.Garber@colostate.edu">Anna.Garber@colostate.edu</a></td>
</tr>
<tr>
<td>Joanna Hinde</td>
<td>Mon 10:00-11:00 am</td>
<td>Yates 310</td>
<td>6</td>
<td><a href="mailto:Joanna.Hinde@colostate.edu">Joanna.Hinde@colostate.edu</a></td>
</tr>
</tbody>
</table>

Office Hours: Please contact the instructors or TAs at least a day in advance to schedule an appointment. We will be happy to assist you with any questions you may have.

References: Lab exercises and report forms will be made available in the form of a purchasable packet from the Bookstore. Additional exercises and supporting material will be posted on RamCt and should be downloaded prior to the lab period. It is your responsibility to print them out and to bring them to the lab.

Course Description: This laboratory course is an introduction to important techniques currently employed by cell biologists. We start with a review of basic principles such as units used in experimental cell biology, data collection and analysis. Later sessions introduce techniques such as UV/visible spectrophotometry in the study of protein and solute concentrations, purification of enzymes and enzyme kinetics, protein gel electrophoresis in the study and analysis of proteins, and immunoassays in the detection of antigens or antibodies in organisms or tissue extracts. Students will also gain experience in basic principles of light microscopy and fluorescence cell staining in the study of cell structure and types. Additionally, methods for studying respiration and photosynthesis will be covered.

Background information and a brief description of the protocol will be introduced either in the recitation or briefly before the lab but it is your responsibility to be prepared for the lab by doing the pre-lab write-up in your lab notebook (see pg 3).
SCHEDULE

Week of: LECTURE AND LABORATORY

1- Aug 26 Recitation: Course overview, Organization; Introduction to Concentrations of Solutions, Small Volume Measurement, Accuracy and Precision of Data Measurement
Lab Exercise: Check into Laboratory; Concentrations of Solutions, Accuracy and Precision of Instruments

2- Sept 2 Recitation: Cancelled, Labor Day Holiday
Lecture - Introduction to Immunoassays
Exercise: Enzyme Linked Immunosorbent Assay; ELISA

3- Sept 9 Recitation: Introduction to Spectrophotometry and Enzyme Kinetics
Exercise: ENZYMES I: Partial Purification and Characterization of Tyrosine Enzyme from Potato Tubers.

4- Sept 16 Recitation: Effect of the Environment on Enzyme Activity
Exercise: ENZYMES II: Effects of Enzyme Concentration, pH and Temperature on Enzyme Activity
Library instructions

5- Sept 23 Recitation: Parameters of Enzyme Kinetics
Exercise: ENZYMES III: Kinetic analysis of the Tyrosinase Enzyme: $K_M$ and $V_{MAX}$; Enzyme inhibitor analysis

6- Sept 30 Recitation: Characterization of Proteins: Protein Gel Electrophoresis and Determination of Protein Concentration
Exercise: Gel Electrophoresis: Assessing the Purity of Tyrosinase Enzyme by SDS PAGE, Quantitative Determination of Protein Concentration by Colorimetric Assays,

7- Oct 7 Recitation: Review session.
EXAM I, Lab Notebooks DUE

8- Oct 14 Recitation: Introduction to Microscopy I: Types and Proper Use
Exercise: Introduction to the Compound Light Microscope

9- Oct 21 Recitation: Microscopy II: Cell Structure
Exercise: Microscope Viewing: Cells of living organisms

10- Oct 28 Recitation: The Study of Cell Functions; Cell fractionation, Mitochondria Isolation and Respiration
Exercise: Qualitative Assay of Mitochondrial Respiration

11- Nov 4 Recitation: The Study of Cell Functions; Introduction to Photosynthesis: Light/Hill Reactions
Exercise: Chloroplast Isolation and Quantitative Assay of Hill reaction

12- Nov 11 Recitation: Introduction to Fluorescence Microscopy
Exercise: Immunostaining of Cells for Fluorescence Microscopy

Exercise: Fluorescence- Stained Cell viewing, Cell Viability Assay

14- Nov 25-29 Fall Recess: Thanksgiving Break

15- Dec 2 Recitation: Cell Signal Transduction and Cell Cycle: Yeast pheromones
Exercise: Experimental Design Workshop

16- Dec 9 Recitation: Review session
EXAM II, Lab Notebooks DUE, checkout and evaluation

Execution of Experiments: Students will work in pairs; a two-student team will be assigned a section of the laboratory bench and will work together using instrumentation and equipment found in a typical cell biology research laboratory. All written work will be done individually.
Laboratory Notebooks: (200 points)

Pre-laboratory Write-up and preparation: A Lab Notebook should be used to plan the pre-lab portions of the experiment. The Title & Date, Introduction and Materials and Methods sections should be completed before you come to the recitation. Pre-lab write-ups should be in the student’s wording and not copied directly from the handouts. Pre-lab planning will help the students to do well on the open notebook quizzes and to conduct and finish the experiments in a timely manner.

A secure spine-bound, not spiral bound, no tear out page perforations notebook is used to outline the experiment before the lab period, document your experimental data and conclusions. Laboratory notebook will be collected twice during the semester and graded according to the criteria below. Any calculations, notes, and results should be recorded in ink (ball-point pens) directly into the notebook. The laboratory notebook of a scientist is a legal document that shows the progress of experiments on a given day. It is written in as the experiment proceeds, and nothing should be erased or obliterated. Mistakes are crossed out with a single line so the original work is still visible. Your notebook should be legible and should contain the following:

A) Table of Contents: at the beginning of your notebook, dedicate a few pages for use as a table of contents which includes title of each experiment and page numbers for each experiment. Keep it up to date as you write in your notebook.

B) Title and Date: this section should be written before class. The title of each experiment needs to be descriptive yet concise. It is crucial to record on what date (and possibly what time, if applicable) the experiment was carried out.

C) Introduction: This section should be written with your own wording before the lab period. The introduction section briefly summarizes 1) the theory behind the experiment (not more than 3 to 5 sentences), 2) the question to be investigated based upon the background (one sentence), 3) hypothesis which includes the predicted results (one to two sentences maximum), and 4) the objectives of the experiment (one to two sentences). Cutting and pasting from handouts’ material is NOT allowed.

D) Materials and Methods: This section should be written before the lab period and then modified as needed during the conduction of the experiment. The experiment section should contain the materials and reagents, the equipment used and the methods (protocol). Use a flow sheet of the protocol whenever possible. One should be able to repeat the experiment using only the methods you have written in your notebook.

E) Results and discussion: Completed during and after the experiment. The results section contains your observations, sketches of biological specimens, raw data, calculations, and tables and graphs that you generate from the data, as well as any other notes. For legal reasons such as patents of experimental results, your raw data should go directly into your notebook. However, for the purpose of this class only, your lab report (after grading) may be taped or stapled to the notebook to serve as a Results and Discussion section.

F) Graphing: when graphing is called for, students may use either provided graphing paper or a computer to generate graphs. Hand drawn graphs on regular paper are unacceptable. You are expected to keep e-copies of graphs.

G) Conclusions: (Not more than 10 sentences) This section is written right after the experiment is completed or after you write your report and before you submit it for grading. Summarize 1) the results of the experiment, 2) your interpretation of the results, 3) the significance of your findings 4) what you learned from this experiment, and 5) what would you do next to carry over and expand the results. 6) answer the question:
“did I achieve my objective/s?” Be critical with regard to your data. Just because you may have followed the protocol does not mean that your experiment succeeded. An important objective of this course is to learn to critically evaluate data. Analyze your results and comment on why an experiment failed, if necessary. If the failed experiment is not repeated, state what you might do differently to derive a successful outcome or what you could do to improve it in the future.

Post-laboratory clean-up: At the end of each laboratory period you are required to clean your bench area, properly dispose of experimental waste, dump ice, wash any used glassware with hot water and detergent and put away all assigned equipment. Finally, wipe your bench with a cleaner disinfectant before you leave. Note that sloppy clean-ups or failure to comply with these instructions will affect your lab technique grade.

Exams (200 points each): There will be a midterm and a final exam.

Quizzes (20 points each): A weekly open notebook quiz will cover the current week’s lab (pre-lab write-up and background principles) and more comprehensive material from the previous week’s lab. Students who come prepared, maintain a well-organized notebook and are conscientious in their observations and data evaluation/processing should do well on quizzes and laboratory reports.

Laboratory Reports (50 to 100 points each)
Students will be required to turn in a laboratory report containing sketches of observations, tables, and/or graphs. The reports will be a mix of data reporting and critical thinking responses. Students are strongly encouraged to complete the Report during the lab period. Laboratory reports will be due the following Monday at the end of Recitation. Late laboratory reports will not be tolerated. 10 points per day will be deducted for late reports. (Weekends will count as one day).

Keys to success:

1. Write legibly. Handwritten answers must be readable. If your handwriting is messy, type your lab reports. If something is illegible, it will NOT be graded and you will have to re-do your submission; this will result in the deduction of points (see point 7 below).
2. In problem-solving, show all your work and calculations; do not simply write the answer. Write out everything of importance. The bottom line is that your math has to be easy to follow. If a problem asks for repetitive calculations, provide one Example calculation only, and indicate that in the answer.
3. Always include units (note: some values are unitless), including on graphs.
4. Everything you submit for evaluation must be solidly stapled together.
5. Every page you include as an add-on to your lab report must have your name, page number, and section # on it.
6. A reasonable level of aesthetics on submitted assignments is expected. Torn or dirty paper will not be accepted, nor paper previously used for other purposes (i.e. turning in a report with unrelated writing on it).
7. Unless a valid reason is supplied, lab reports or any other assignment turned in late will be subject to point reduction at the Instructor’s discretion. Late submissions and resubmissions may be turned in to the Instructors’ mailboxes in the Biochemistry office room 316 MRB.

Laboratory Technique Grade (100 points): 10 points per lab assess students’ lab notebook pre-lab write-up, student participation in the lab, accuracy in following the experimental protocols and obtaining data, following the rules of the lab including tidiness and the careful use of the lab supplies and materials.

Coming prepared to work during the lab period is essential to success. Relying on your lab partner to do the work is not acceptable. Instructors will ascertain student participation when assigning lab tech grades. Scientific research and experimentation require special qualities of patience, organization, and accuracy: Careful experimental planning (i.e., laying out the sequence of the steps in a protocol) and good time management will
help you efficiently obtain accurate and successful experimental results. Note that due to the nature of biological research, some experiments require that you come during a later time of the day or week to finish up some steps or make observations.

Recitation: Attendance is mandatory. The recitation lecture will provide theoretical principles behind the week’s experiments, as well as pointers and potential changes in the protocol. Discussions and questions about the previous lab and report writing will be addressed here. A quiz will be given weekly at the end of the recitation period.

Success in the lab: Your attentiveness and participation are keys to your success in the lab. The lab period is about 3 hours, and—with few exceptions— you are expected to complete each experiment and work on the report. Group discussions with your peers and the TAs regarding questions in the report are highly encouraged.

Grading

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<tr>
<td>A</td>
<td>90 to 95%</td>
</tr>
<tr>
<td>B+</td>
<td>85.1 to 89.9</td>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
<td>70 to 79.9%</td>
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<tr>
<td>D</td>
<td>55 to 69.9%</td>
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<td>F</td>
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Point allocation:

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<tr>
<td>Laboratory Reports</td>
<td>50-100 pts ea</td>
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<td>Laboratory Notebook</td>
<td>100 pts ea</td>
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<tr>
<td>Lab technique grade</td>
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<td>EXAMS</td>
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<td><strong>Total</strong></td>
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Missing laboratory sessions:
Missing lab activities cannot be made up and will result in a Zero score on the Lab Report. If you cannot attend a lab, email or see your lab Instructor (not the TA) in advance to arrange to attend another laboratory section.

RamCT
Students are required to make use of RamCT to keep abreast of important announcements, discussions and course materials. Go to [http://ramct.blackboard.com](http://ramct.blackboard.com) and log in with your eID and password. Under the LIFE212 course header, you will find all the materials you need for this lab, including a message board which you can use to exchange information with fellow students. However, do not rely on the discussion board to send a message to the instructors or the TA’s. Instead, please email them directly.

Cheating/Plagiarism
All written work in quizzes, reports and exams shall be the work of the individual student; using another student’s work is considered cheating. Falsification of data from experiments is also considered cheating. Plagiarism is the use of information without appropriate citation of sources. LIFE212 Quizzes allow use of open Notebook. This is meant to encourage detailed note-taking. An open Lab Manual during Quizzes is not allowed; such use is also considered cheating. Plagiarism and cheating are academically dishonest and, as such will incur penalties in accordance with CSU policy.

Appropriate use of Resources: If Internet or primary literature sources are used, they must be cited every time they are used in a written assignment.

Penalties for cheating/plagiarism/data falsification: In accordance with CSU Academic Integrity Policies, cheating/plagiarism may result in a reduced grade for a given assignment, a failing grade for the course or the removal of the repeat/delete option for the course.
Addendum to the Syllabus: Lab Report 11
Scientific Paper Writing Schedule

Introduction: The report for the Fluorescent Microscopy (FM) Lab # 11 will be a formal lab report paper written in the form of a publishable scientific journal article. To help students and teach them how to write a scientific paper, we broke down the assignment into stages: Parts of the paper will be due at various milestones during the semester. Submitted portions of the paper will be graded and feedback will be provided to the student. This allows students to finish sections of the paper early and use the grading feedback to make improvements to the paper before turning in the final product. Since the paper is assigned to a lab experiment that is conducted later in the semester, a reading assignment will first be given to help students understand the background behind the experiment. For instructions on how to write the paper, students will follow the guidelines for the writing assignment (Report 11) in the manual.

Timelines for the assignments (40 points):

<table>
<thead>
<tr>
<th>Date</th>
<th>week</th>
<th>Assignments/Due</th>
<th>Notes</th>
</tr>
</thead>
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<tr>
<td>August 26th, 2013</td>
<td>First week of classes</td>
<td>Brief description of the staged assignment and deadlines handed out with the syllabus</td>
<td>Assignment will be described briefly as an Addendum to the syllabus</td>
</tr>
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</table>
| October 7th, 2013     | Midterm Week     | **Assignment**: Reading about FM and the cytoskeleton.
                           Take home quiz, | Take home quiz about FM and the cytoskeleton |
| October 14th, 2013    | Week 8           | **Due**: Take home quiz (10 pts)
                           **Assignment**: 1) Title and Author
                                           2) Literature Search and synopsis: at least three related articles. | GTAs will grade and give feedback |
| October 21st, 2013    | Week 9           | No assignment due | GTAs will grade and give feedback |
| October 28th, 2013    | Week 10          | **Due**: 1) Title and Author (3 pts)
                           2) Literature Search(8 pts)
                           **Assignment**: Introduction | GTAs will grade and give feedback |
| November 4th, 2013    | Week 11          | **Due**: Introduction section (8 pts)
                           **Assignment**: 1) Materials and Methods
                                           2) Abstract without results | GTAs will grade and give feedback |
| November 11th, 2013   | Week 12          | **Due**: 1) Materials and methods (6 pts)
                                           2)Abstract: without results (5 pts.) | GTAs will grade and give feedback |
| November 18th, 2013   | Week 13          | Fluorescence Lab practicum Questions | GTAs will return graded assignments with feedback |
| December 2, 2013      | Week 15: after Thanksgiving | **Paper due**: Results and discussion and whole paper based upon the guidelines in the manual | Instructors will grade and give final feedback |